

$\Sigma(1750) 1/2^-$

$I(J^P) = 1(\frac{1}{2}^-)$ Status: ***

For most results published before 1974 (they are now obsolete), see our 1982 edition Physics Letters **111B** 1 (1982).

There is evidence for this state in many partial-wave analyses, but with wide variations in the mass, width, and couplings. The latest analyses indicated significant couplings to $N\bar{K}$ and $\Lambda\pi$, as well as to $\Sigma\eta$ whose threshold is at 1746 MeV (JONES 74).

$\Sigma(1750)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
1730 to 1800 (≈ 1750) OUR ESTIMATE			
1756±10	GOPAL	80	DPWA $\bar{K}N \rightarrow \bar{K}N$
1770±10	ALSTON-...	78	DPWA $\bar{K}N \rightarrow \bar{K}N$
1770±15	GOPAL	77	DPWA $\bar{K}N$ multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •			
1800 or 1813	¹ MARTIN	77	DPWA $\bar{K}N$ multichannel
1715±10	² CARROLL	76	DPWA Isospin-1 total σ
1730	DEBELLEFON	76	IPWA $K^- p \rightarrow \Lambda\pi^0$
1780±30	BAILLON	75	IPWA $\bar{K}N \rightarrow \Lambda\pi$ (sol. 1)
1700±30	BAILLON	75	IPWA $\bar{K}N \rightarrow \Lambda\pi$ (sol. 2)
1697 ⁺²⁰ ₋₁₀	VANHORN	75	DPWA $K^- p \rightarrow \Lambda\pi^0$
1785±12	CHU	74	DBC Fits $\sigma(K^- n \rightarrow \Sigma^-\eta)$
1760± 5	³ JONES	74	HBC Fits $\sigma(K^- p \rightarrow \Sigma^0\eta)$
1739±10	PREVOST	74	DPWA $K^- N \rightarrow \Sigma(1385)\pi$

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$\Sigma(1750)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
60 to 160 (≈ 90) OUR ESTIMATE			
64±10	GOPAL	80	DPWA $\bar{K}N \rightarrow \bar{K}N$
161±20	ALSTON-...	78	DPWA $\bar{K}N \rightarrow \bar{K}N$
60±10	GOPAL	77	DPWA $\bar{K}N$ multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •			
117 or 119	¹ MARTIN	77	DPWA $\bar{K}N$ multichannel
10	² CARROLL	76	DPWA Isospin-1 total σ
110	DEBELLEFON	76	IPWA $K^- p \rightarrow \Lambda\pi^0$
140±30	BAILLON	75	IPWA $\bar{K}N \rightarrow \Lambda\pi$ (sol. 1)
160±50	BAILLON	75	IPWA $\bar{K}N \rightarrow \Lambda\pi$ (sol. 2)
66 ⁺¹⁴ ₋₁₂	VANHORN	75	DPWA $K^- p \rightarrow \Lambda\pi^0$
89±33	CHU	74	DBC Fits $\sigma(K^- n \rightarrow \Sigma^-\eta)$
92± 7	³ JONES	74	HBC Fits $\sigma(K^- p \rightarrow \Sigma^0\eta)$
108±20	PREVOST	74	DPWA $K^- N \rightarrow \Sigma(1385)\pi$

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$\Sigma(1750)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 N\bar{K}$	10–40 %
$\Gamma_2 \Lambda\pi$	seen
$\Gamma_3 \Sigma\pi$	<8 %
$\Gamma_4 \Sigma\eta$	15–55 %
$\Gamma_5 \Sigma(1385)\pi$	
$\Gamma_6 \Lambda(1520)\pi$	

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DESIG=2;OUR EST

DESIG=5

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The above branching fractions are our estimates, not fits or averages.

$\Sigma(1750)$ BRANCHING RATIOS

See "Sign conventions for resonance couplings" in the Note on Λ and Σ Resonances.

$\Gamma(N\bar{K})/\Gamma_{\text{total}}$		Γ_1/Γ	
VALUE	DOCUMENT ID	TECN	COMMENT
0.1 to 0.4 OUR ESTIMATE			
0.14 ± 0.03	GOPAL 80	DPWA	$\bar{K}N \rightarrow \bar{K}N$
0.33 ± 0.05	ALSTON-... 78	DPWA	$\bar{K}N \rightarrow \bar{K}N$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.15 ± 0.03	GOPAL 77	DPWA	See GOPAL 80
0.06 or 0.05	¹ MARTIN 77	DPWA	$\bar{K}N$ multichannel

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{\text{total}}$ in $N\bar{K} \rightarrow \Sigma(1750) \rightarrow \Lambda\pi$		$(\Gamma_1\Gamma_2)^{1/2}/\Gamma$	
VALUE	DOCUMENT ID	TECN	COMMENT
0.04 ± 0.03	GOPAL 77	DPWA	$\bar{K}N$ multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •			
-0.10 or -0.09	¹ MARTIN 77	DPWA	$\bar{K}N$ multichannel
-0.12	DEBELLEFON 76	IPWA	$K^- p \rightarrow \Lambda\pi^0$
-0.12 ± 0.02	BAILLON 75	IPWA	$\bar{K}N \rightarrow \Lambda\pi$ (sol. 1)
-0.13 ± 0.03	BAILLON 75	IPWA	$\bar{K}N \rightarrow \Lambda\pi$ (sol. 2)
-0.13 ± 0.04	VANHORN 75	DPWA	$K^- p \rightarrow \Lambda\pi^0$
-0.120 ± 0.077	DEVENISH 74B		Fixed-t dispersion rel.

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{\text{total}}$ in $N\bar{K} \rightarrow \Sigma(1750) \rightarrow \Sigma\pi$		$(\Gamma_1\Gamma_3)^{1/2}/\Gamma$	
VALUE	DOCUMENT ID	TECN	COMMENT
-0.09 ± 0.05	GOPAL 77	DPWA	$\bar{K}N$ multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •			
+0.06 or +0.06	¹ MARTIN 77	DPWA	$\bar{K}N$ multichannel
0.13 ± 0.02	LANGBEIN 72	IPWA	$\bar{K}N$ multichannel

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{\text{total}}$ in $N\bar{K} \rightarrow \Sigma(1750) \rightarrow \Sigma\eta$		$(\Gamma_1\Gamma_4)^{1/2}/\Gamma$	
VALUE	DOCUMENT ID	TECN	COMMENT
0.23 ± 0.01	³ JONES 74	HBC	Fits $\sigma(K^- p \rightarrow \Sigma^0 \eta)$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
seen	CLINE 69	DBC	Threshold bump

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{\text{total}}$ in $N\bar{K} \rightarrow \Sigma(1750) \rightarrow \Sigma(1385)\pi$		$(\Gamma_1\Gamma_5)^{1/2}/\Gamma$	
VALUE	DOCUMENT ID	TECN	COMMENT
+0.18 ± 0.15	PREVOST 74	DPWA	$K^- N \rightarrow \Sigma(1385)\pi$

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{\text{total}}$ in $N\bar{K} \rightarrow \Sigma(1750) \rightarrow \Lambda(1520)\pi$		$(\Gamma_1\Gamma_6)^{1/2}/\Gamma$	
VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.032 ± 0.021	CAMERON 77	DPWA	P-wave decay

$\Sigma(1750)$ FOOTNOTES

- ¹The two MARTIN 77 values are from a T-matrix pole and from a Breit-Wigner fit.
- ²A total cross-section bump with $(J+1/2) \Gamma_{\text{el}} / \Gamma_{\text{total}} = 0.30$.
- ³An S-wave Breit-Wigner fit to the threshold cross section with no background and errors statistical only.

$\Sigma(1750)$ REFERENCES

PDG	82	PL 111B 1	M. Roos <i>et al.</i>	(HELS, CIT, CERN)
GOPAL	80	Toronto Conf. 159	G.P. Gopal	(RHEL) IJP
ALSTON-...	78	PR D18 182	M. Alston-Garnjost <i>et al.</i>	(LBL, MTHO+) IJP
Also		PRL 38 1007	M. Alston-Garnjost <i>et al.</i>	(LBL, MTHO+) IJP
CAMERON	77	NP B131 399	W. Cameron <i>et al.</i>	(RHEL, LOIC) IJP
GOPAL	77	NP B119 362	G.P. Gopal <i>et al.</i>	(LOIC, RHEL) IJP
MARTIN	77	NP B127 349	B.R. Martin, M.K. Pidcock, R.G. Moorhouse	(LOUC+) IJP
Also		NP B126 266	B.R. Martin, M.K. Pidcock	(LOUC) IJP
Also		NP B126 285	B.R. Martin, M.K. Pidcock	(LOUC) IJP
CARROLL	76	PRL 37 806	A.S. Carroll <i>et al.</i>	(BNL) IJP
DEBELLEFON	76	NP B109 129	A. de Bellefon, A. Berthon	(CDEF) IJP
BAILLON	75	NP B94 39	P.H. Baillon, P.J. Litchfield	(CERN, RHEL) IJP
VANHORN	75	NP B87 145	A.J. van Horn	(LBL) IJP
Also		NP B87 157	A.J. van Horn	(LBL) IJP
CHU	74	NC 20A 35	R.Y.L. Chu <i>et al.</i>	(PLAT, TUFTS, BRAN) IJP
DEVENISH	74B	NP B81 330	R.C.E. Devenish, C.D. Froggatt, B.R. Martin	(DESY+) IJP
JONES	74	NP B73 141	M.D. Jones	(CHIC) IJP
PREVOST	74	NP B69 246	J. Prevost <i>et al.</i>	(SACL, CERN, HEID) IJP
LANGBEIN	72	NP B47 477	W. Langbein, F. Wagner	(MPIM) IJP
CLINE	69	LNC 2 407	D. Cline, R. Laumann, J. Mapp	(WISC) IJP

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